

We claim:

1. Apparatus for identifying a blank segment in a set of visual recording data, comprising:

5        a plurality of blank frame detectors, each blank frame detector adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame; and

10      a blank segment detector, the blank segment detector adapted to evaluate a characteristic of a plurality of frames of visual recording data to determine whether the plurality of frames of visual recording data is a blank segment comprising a plurality of blank frames.

2. Apparatus as in Claim 1, wherein:

15      the plurality of blank frame detectors comprise first and second blank frame detectors;

20      the first blank frame detector is adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame of a first type; and

25      the second blank frame detector is adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame of a second type, the second type being different from the first type.

3. Apparatus as in Claim 1, wherein at least one of the plurality of blank frame detectors is adapted to detect frames of visual recording data that represent an image that is all or nearly all one color.

4. Apparatus as in Claim 3, wherein at least one of the plurality of blank frame detectors is adapted to detect frames of visual recording data that represent an image that is all or nearly all blue or purple.

5 5. Apparatus as in Claim 3, wherein at least one of the plurality of blank frame detectors is adapted to detect frames of visual recording data that represent an image that is all or nearly all silver.

10 6. Apparatus as in Claim 3, wherein at least one of the plurality of blank frame detectors is adapted to detect frames of visual recording data that represent an image that is all or nearly all black.

15 7. Apparatus as in Claim 1, further comprising means for evaluating a determination that a frame of visual recording data is a blank frame to either confirm or reject the determination.

8. Apparatus for identifying a blank segment in a set of visual recording data, comprising:

20 a blank frame detector, the blank frame detector adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame of a first type or of a second type that is different from the first type; and

25 a blank segment detector, the blank segment detector adapted to evaluate a characteristic of a plurality of frames of visual recording data to determine whether the plurality of frames of visual recording data is a blank segment comprising a plurality of blank frames.

9. Apparatus for identifying a blank segment in a set of visual recording data, comprising:

5           a blank frame detector, the blank frame detector adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame representing an image that is all or nearly all one color, wherein the blank frame detector further comprises:

10           means for determining if, for each color component, the numerical value of a specified number of the pixels of the frame is within a specified magnitude of the average numerical value of that color component for all of the pixels of the frame; and

15           means for determining if the average numerical value of each color component for all of the pixels of the frame is within a specified range and/or has a specified relationship with the average numerical value of one or more other color components, wherein:

20           if, for each color component, the numerical value of the specified number of the pixels of the frame is within the specified magnitude of the average numerical value of that color component for all of the pixels of the frame, and if the average numerical value of each color component for all of the pixels of the frame is within a specified range and/or has a specified relationship with the average numerical value of one or more other color components, then the frame is a blank frame; and

25           a blank segment detector, the blank segment detector adapted to evaluate a characteristic of a plurality of frames of visual recording data to

determine whether the plurality of frames of visual recording data is a blank segment comprising a plurality of blank frames.

10. Apparatus as in Claim 9, wherein:

5       the numerical value of each color component of each pixel can vary between 0 and 255 inclusive;

      the specified number of pixels is greater than or equal to 80% of the pixels; and

      the specified magnitude is 8.

10      11. Apparatus as in Claim 10, wherein the blank frame detector is adapted to detect frames of visual recording data that represent an image that is all or nearly all blue or purple.

12. Apparatus as in Claim 11, wherein:

15       each pixel of the frame of visual recording data is represented by a red color component, a green color component and a blue color component, each color component having a value between 0 and 255 inclusive;

20       the specified range for the red color component is less than 25;

      the specified range for the green color component is less than 25;

      the specified range for the blue color component is between 60 and 130;

25       the magnitude of the red color component subtracted from the green color component is less than 20;

      the magnitude of the green color component subtracted from the blue color component is less than 50; and

30       the magnitude of the red color component subtracted from the blue color component is less than 85.

13. Apparatus as in Claim 10, wherein the blank frame detector is adapted to detect frames of visual recording data that represent an image that is all or nearly all silver.

14. Apparatus as in Claim 13, wherein

5        each pixel of the frame of visual recording data is represented by a red color component, a green color component and a blue color component, each color component having a value between 0 and 255 inclusive;

10        the specified range for the red color component is between 60 and 130;

            the specified range for the green color component is between 60 and 130;

            the specified range for the blue color component is between 60 and 130;

15        the absolute value of the difference between the magnitude of the red color component and the magnitude of the green color component is less than 10;

20        the absolute value of the difference between the magnitude of the green color component and the magnitude of the blue color component is less than 10; and

            the absolute value of the difference between the magnitude of the red color component and the magnitude of the blue color component is less than 10.

15. Apparatus as in Claim 10, wherein the blank frame detector is adapted to detect frames of visual recording data that represent an image that is all or nearly all black.

16. Apparatus as in Claim 15, wherein:

30        each pixel of the frame of visual recording data is represented by a red color component, a green color component and a blue color component, each color component having a value between 0 and 255 inclusive;

the specified range for the red color component is less than 10;

the specified range for the green color component is less than 10; and

5 the specified range for the blue color component is less than 10.

17. Apparatus for identifying a blank segment in a set of visual recording data, comprising:

10 a blank frame detector, the blank frame detector adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame, wherein the blank frame detector further comprises:

15 means for determining if a specified maximum variation from pure gray at each pixel is less than a specified magnitude;

20 means for determining if the average numerical value of each color component for all of the pixels of the frame is within a specified range and/or has a specified relationship with the average numerical value of one or more other color components; and

25 means for determining if the vertical and horizontal correlation coefficients are within corresponding specified ranges and/or have a specified relationship with one another, wherein:

30 if the specified maximum variation from pure gray at each pixel is less than a specified magnitude, the average numerical value of each color component for all of the pixels of the frame is within a specified range and/or has a specified relationship with the average numerical value of one or more other color components, and the vertical and horizontal correlation coefficients are within

corresponding specified ranges and/or have a specified relationship with one another, then the frame is a blank frame; and

5           a blank segment detector, the blank segment detector adapted to evaluate a characteristic of a plurality of frames of visual recording data to determine whether the plurality of frames of visual recording data is a blank segment comprising a plurality of blank frames.

10       18. Apparatus as in Claim 17, wherein:

each pixel of the frame of visual recording data is represented by a red color component, a green color component and a blue color component, each color component having a value between 0 and 255 inclusive;

15       the maximum variation from pure gray of each color component at each pixel is less than 15;

the specified range for the green color component is between 5 and 45;

20       the absolute value of the difference between the magnitude of the red color component and the magnitude of the green color component is less than 5;

the absolute value of the difference between the magnitude of the green color component and the magnitude of the blue color component is less than 5; and

25       the absolute value of the difference between the magnitude of the red color component and the magnitude of the blue color component is less than 5;

the vertical correlation coefficient is less than 0.41;

30       the horizontal correlation coefficient is less than 0.85; and

the horizontal correlation coefficient is greater than twice the vertical correlation coefficient.

19. Apparatus for identifying a blank segment in a set  
of visual recording data, comprising:

5            a blank frame detector, the blank frame detector  
adapted to evaluate a frame of visual recording data to  
determine whether the frame of visual recording data is  
a snow-static frame;

10            a blank segment detector, the blank segment  
detector adapted to evaluate a characteristic of a  
plurality of frames of visual recording data to  
determine whether the plurality of frames of visual  
recording data is a blank segment comprising a plurality  
of blank frames; and

15            means for evaluating, when a frame is determined to  
be a snow-static frame, the temporal correlation  
coefficient over a specified window of frames of visual  
recording data that includes the snow-static frame to  
either confirm or reject the determination that the  
frame is a snow static frame.

20. Apparatus as in Claim 19, wherein the means for  
evaluating the temporal correlation coefficient further  
comprises:

25            means for determining if all of the frames in the  
window are snow-static frames;

means for determining if at least one of the frames  
in the window has a temporal correlation coefficient  
with greater than a first specified magnitude; and

means for determining if at least one of the frames  
in the window has a temporal correlation coefficient  
with less than a second specified magnitude.

30            21. Apparatus as in Claim 20, wherein:

the first specified magnitude is 0.98; and  
the second specified magnitude is 0.02.

22. Apparatus for identifying a blank segment in a set of visual recording data, comprising:

5        a blank frame detector, the blank frame detector adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame; and

10      a plurality of blank segment detectors, each blank segment detector adapted to evaluate a characteristic of a plurality of frames of visual recording data to determine whether the plurality of frames of visual recording data is a blank segment comprising a plurality of blank frames.

23. Apparatus as in Claim 22, wherein:

15      the plurality of blank segment detectors comprise first and second blank segment detectors;

the first blank segment detector is adapted to detect blank segments including blank frames of a first type; and

20      the second blank segment detector is adapted to detect blank segments including blank frames of a second type, the second type being different from the first type.

24. Apparatus for identifying a blank segment in a set of visual recording data, comprising:

25      a blank frame detector, the blank frame detector adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame; and

30      a blank segment detector, the blank segment detector adapted to evaluate a characteristic of a plurality of frames of visual recording data to determine whether the plurality of frames of visual recording data is a blank segment comprising a plurality

of blank frames including one or more blank frames of a first type and one or more blank frames a second type that is different from the first type.

25. Apparatus as in Claim 24, wherein the blank segment detector is adapted to detect a first type of blank segment including blank frames of a first type, or a second type of blank segment including blank frames of a second type that is different from the first type of blank frames.

26. Apparatus for identifying a blank segment in a set of visual recording data, comprising:

a blank frame detector, the blank frame detector adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame; and

15 a blank segment detector, the blank segment detector adapted to evaluate a characteristic of a plurality of frames of visual recording data to determine whether the plurality of frames of visual recording data is a blank segment comprising a plurality of blank frames that represent an image that is all or 20 nearly all one color.

27. Apparatus as in Claim 26, wherein the blank segment detector is adapted to detect blank segments including blank frames that represent an image that is all or nearly all blue 25 or purple.

28. Apparatus as in Claim 26, wherein the blank segment detector is adapted to detect blank segments including blank frames that represent an image that is all or nearly all silver.

29. Apparatus as in Claim 26, wherein the blank segment detector is adapted to detect blank segments including blank frames that represent an image that is all or nearly all black.

5       30. Apparatus as in Claim 26, wherein the blank segment detector further comprises means for determining if there are a specified number of frames in a sequence of frames that have been determined to be blank frames of the same color, wherein if there are a specified number of frames in the  
10 sequence of frames that have been determined to be blank frames of the same color, then the segment is a blank segment.

31. Apparatus as in Claim 30, wherein the specified number of frames is 95% of the frames in the sequence of  
15 frames after the first 6 frames in the sequence of frames.

32. Apparatus as in Claim 30, wherein the blank segment detector further comprises means for determining if the blank frames of the same color in the sequence of frames differ in color by no more than a specified amount, wherein if there  
20 are a specified number of frames in the sequence of frames that have been determined to be blank frames of the same color and the blank frames of the same color in the sequence of frames differ in color by no more than a specified amount, then the segment is a blank segment.

25       33. Apparatus as in Claim 32, wherein the specified amount is a variance of the average color of the frames of the same color of less than 10.

34. Apparatus for identifying a blank segment in a set of visual recording data, comprising:

5           a blank frame detector, the blank frame detector adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame; and

10           a blank segment detector, the blank segment detector adapted to evaluate a characteristic of a plurality of frames of visual recording data to determine whether the plurality of frames of visual recording data is a snow-static segment comprising a plurality of blank frames that represent an image that is all or nearly all snow-static.

15           35. Apparatus as in Claim 34, wherein the blank segment detector further comprises means for determining if there are a specified number of frames in a sequence of frames that have been determined to be snow-static frames, wherein if there are a specified number of frames in the sequence of frames that have been determined to be snow-static frames,  
20 then the segment is a blank segment.

36. Apparatus as in Claim 35, wherein the specified number of frames is 95% of the frames in the sequence of frames after the first 6 frames in the sequence of frames.

37. Apparatus as in Claim 35, wherein the blank segment  
25 detector further comprises:

              means for determining if a specified number of frames in the sequence of frames have been identified either as black screen frames or snow-static frames;

30           means for determining if the black screen frames in the sequence of frames differ in color by no more than a specified amount, wherein:

if there are a specified number of frames in a sequence of frames that have been determined to be snow-static frames, a specified number of frames in the sequence of frames have been identified either as black screen frames or snow-static frames, and the black screen frames in the sequence of frames differ in color by no more than a specified amount, then the segment is a blank segment.

5           38. Apparatus as in Claim 37, wherein:

10           the specified number of snow-static frames in the sequence of frames is 5;

              the specified number of frames is 95% of the frames in the sequence of frames after the first 6 frames of the sequence of frames; and

15           the specified amount is a variance of the average color of the black frames of less than 10.

20           39. Apparatus for identifying a blank segment in a set of visual recording data, comprising:

              a blank frame detector, the blank frame detector adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame; and

25           a blank segment detector, the blank segment detector adapted to evaluate a characteristic of a plurality of frames of visual recording data to determine whether the plurality of frames of visual recording data is a blank segment comprising a plurality of blank frames, wherein:

              the blank frame and blank segment determinations are made for successive frames of visual recording data as the frames of visual recording data are acquired or as the frames of visual recording data are being processed for another purpose.

40. Apparatus as in Claim 39, further comprising means for communicating a categorization of a current segment to another process operating on the set of visual recording data.

5       41. Apparatus as in Claim 40, wherein the set of visual recording data is initially in an analog form and the other process is a digitization process.

42. Apparatus as in Claim 41, wherein:

10      the means for communicating a current segment categorization further comprises means for communicating the duration of a current blank segment to the digitization process; and

15      the digitization process can be terminated if the duration of the current blank segment exceeds a specified duration.

43. Apparatus as in Claim 40, wherein the means for communicating a current segment categorization further comprises:

20      means for identifying the beginning of a first content segment in the set of visual recording data; and  
          means for communicating the identification of the beginning of the first content segment to the other process operating on the set of visual recording data.

44. Apparatus as in Claim 43, wherein:

25      the other process is a process for recording the set of visual recording data onto a data storage medium; and

30      visual recording data is not recorded onto the data storage medium until the identification of the beginning of the first content segment is communicated to the recording process.

45. Apparatus for identifying a blank segment in a set of visual recording data, comprising:

5           a blank frame detector, the blank frame detector adapted to evaluate a frame of visual recording data to determine whether the frame of visual recording data is a blank frame;

10          a blank segment detector, the blank segment detector adapted to evaluate a characteristic of a plurality of frames of visual recording data to determine whether the plurality of frames of visual recording data is a blank segment comprising a plurality of blank frames; and

15          means for using the detection of one or more blank segments to identify one or more segment boundaries in the set of visual recording data, each segment boundary delineating a transition from a segment of one type to a segment of another type.

46. Apparatus as in Claim 45, further comprising:

20          means for identifying a segment boundary at the beginning of a blank segment; and

              means for marking the identified segment boundary to cause the blank segment following the identified segment boundary to be excluded from subsequent interaction with the set of visual recording data.

25          47. Apparatus as in Claim 46, wherein the set of visual recording data is used to generate a display of the corresponding recorded visual content, a display of the recorded visual content corresponding to the marked segment not being generated.

30          48. Apparatus as in Claim 46, wherein the set of visual recording data is processed in a specified manner, the visual recording data in the marked segment not being processed.

49. Apparatus as in Claim 45, further comprising:  
means for identifying a segment boundary at the  
beginning of a blank segment; and  
means for deleting the visual recording data in the  
blank segment from the set of visual recording data.

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50. Apparatus as in Claim 45, further comprising:  
means for determining the duration of a blank  
segment; and  
means for identifying the end of recorded visual  
content in the set of visual recording data as the  
beginning of a blank segment having greater than a  
specified duration.

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51. A method for identifying a blank segment in a set  
of visual recording data, comprising the steps of:

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evaluating a frame of visual recording data to  
determine whether the frame of visual recording data is  
a blank frame of a first type or of a second type that  
is different from the first type; and

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evaluating a characteristic of a plurality of  
frames of visual recording data to determine whether the  
plurality of frames of visual recording data is a blank  
segment comprising a plurality of blank frames.

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52. A computer readable medium or media encoded with  
one or more computer programs for identifying a blank segment  
in a set of visual recording data, comprising:

instructions for evaluating a frame of visual  
recording data to determine whether the frame of visual  
recording data is a blank frame of a first type or of a  
second type that is different from the first type; and

instructions for evaluating a characteristic of a plurality of frames of visual recording data to determine whether the plurality of frames of visual recording data is a blank segment comprising a plurality of blank frames.